EXHIBIT 18

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

HUAWEI TECHNOLOGIES, CO., LTD. et al., Plaintiffs, v. SAMSUNG ELECTRONICS CO. LTD., et al., Defendants.	Case No. 16-cv-02787-WHO
SAMSUNG ELECTRONICS CO., LTD, & SAMSUNG ELECTRONICS AMERICA, INC. Counterclaim-Plaintiffs, v. HUAWEI TECHNOLOGIES, CO., LTD, HUAWEI DEVICE USA, INC., HUAWI TECHNOLOGIES USA, INC., & HISILICON TECHNOLOGIES CO., LTD., Counterclaim-Defendants.	

EXPERT REPORT OF MICHAEL A.M. DAVIES
April 27, 2018

Table of Contents

I. BACKGROUND AND QUALIFICATIONS

1. My name is Michael Allan Martin Davies. I am Senior Partner and Chairman of Endeavour Partners, LLC, and a Senior Lecturer and Principal Investigator at the Massachusetts Institute of Technology.

2. I have spent more than twenty-five years working in telecommunications, electronics, and related industries. I worked first as an engineer, then as a manager and executive, and now as an academic, consultant, expert, entrepreneur, and advisor. I have worked for a wide variety of technology and manufacturing companies on issues relating to manufacturing, logistics, supply chain management, research and development, product development, technology, strategy, software development and architecture, and innovation. My work involves the connections between technology, innovation, product development, new product adoption and diffusion, consumer choice and behavior, and the emergence and evolution of business ecosystems.

3. I received a Bachelor of Arts and a Master of Arts in Engineering and in Electrical Sciences from St. Catharine's College at the University of Cambridge; a Master of Engineering in Cybernetics, Robotics and Microelectronics from the University of Durham; and a Master of Business Administration from London Business School (with Distinction). My educational work focused on engineering and electrical sciences; cybernetics and robotics; microelectronics including the design of microchips; and management science. I have attached my curriculum vitae as Exhibit 1.

4. I am currently Senior Partner and Chairman of Endeavour Partners, LLC, a strategy consulting firm with expertise in mobile and digital businesses and technologies. I work with companies impacted by the business and technology forces at play in the mobile and digital sectors to help them anticipate technological innovations, consumer needs, and the emergence

and evolution of business ecosystems so they are capable of navigating opportunities for growth and innovation.

5. I have experience working throughout the mobile and digital sectors, including the convergence of mobile, internet, and digital technologies. My work in this area includes the communications sector, such as mobile devices including mobile phones (basic cellular phones, feature phones, smartphones), tablets and phablets, services and networks (broadband and internet), computers (components, hardware, and software), electronic hardware (semiconductors and ICs, PCB design, and manufacturing), consumer electronics, content (video, audio, and applications), and commerce.

6. I began my work in the manufacturing sector on the design, development, and deployment of mechanical, electrical, and high-tech products. For example, as Chief of Strategy for BellSouth International's venture in New Zealand (BellSouth NZ, now Vodafone New Zealand), I collaborated with Apple and Nokia on digital connectivity for the Apple Newton and then with Nokia on the development and testing of the Nokia Communicator 9000, the first smartphone that used digital connectivity. Since then I have focused on supply chain management, the challenge of incorporating high end technologies, building new business models, and developing effective business strategies, among other things.

7. I am CEO and co-founder of a startup whose flagship product is an electronic hardware platform. As founder, I designed, developed, tested, built, and deployed a digital electronic product using semiconductor components, PCB design and prototyping, circuit testing techniques, and manufacturing. In addition, as CEO, I managed the IT operations of this business, which included deployment and maintenance of in-house data servers.

8. I am also a co-founder of a startup, Silverthread, which gives software developers the ability to visualize software design quality and quantify architectural stability, improvement or degradation. As a founder, I recognized the business need of intricately understanding the nuances between integral and modular software architectures. I helped shape the software platform, business model, customer discovery process, and development of the core team.

9. I have also worked on business and technology strategy with many leading mobile device manufacturers ("MDMs") including HTC, Samsung, Nokia, Motorola, Sony Ericsson, and Mitsubishi Electric; supply chain companies such as Qualcomm; and many leading network operators and service providers, including AT&T, Verizon, Vodafone, Sprint Nextel, British Telecom (BT), Deutsche Telekom, Virgin Mobile, and Telecom New Zealand. Specifically, examples of the strategic advice I have provided companies include:

- Qualcomm, a leading component supplier, on evaluating semiconductor and wireless technologies;
- AT&T and AT&T Labs, on consumer choice as it relates to compatibility and wireless technologies;
- Nokia, on product creation, supply chain issues, and inclusion of technologies in mobile devices;
- Mitsubishi Electric, on a wide range of issues pertaining to consumer electronics, consumer segmentation, creative business models, and product portfolios, pipeline, and positioning;
- TRW and other R&D-intensive businesses, on commercializing innovative technologies with a particular focus on semiconductor technologies in analog and digital domains, and software for wireless and broadband applications;
- Motorola, on its R&D Advisory Board, on building business ecosystems, challenging its business strategies, and understanding customers and their likely behavior;
- Samsung, on consumer choice as it relates to wireless technologies, product and service creation, and business ecosystem formation;
- HTC, on consumer choice as it relates to wireless technologies and product and service creation;
- Sony Ericsson, on consumer choice as it relates to wireless technologies and product and service creation;
- Analog Devices, a semiconductor firm, on product strategy and market entry;
- Virgin Mobile, on strategies for data services, market entry, and partnership development; and
- Lucent Technologies, on customer needs and on its strategy for 3G mobile.

10. More recently, my work in this area has focused on the rapid adoption and broader economic and social impact of smartphones, including what is driving this adoption; the key factors that determine consumers' choices and behavior; on products, portfolio and pipeline, and on the broader implications throughout this ecosystem and the economy as a whole over the next three-to-five years. Additionally, my recent work has focused on the underlying technology and supply chain of smartphones and tablets.

11. I have significant experience serving as an expert consultant in this field. I served as an industry expert for the Department of Justice in 2011 in the anti-trust investigation of the proposed AT&T and T-Mobile merger. In this role, I analyzed the impact of the proposed merger, in particular as it related to consumer choice and to the technology and the economics of mobile networks and mobile services.

12. I have served as an expert witness in recent International Trade Commission investigations including ITC Investigation Nos. 337-TA-796, 337-TA-862, 337-TA-866, 337-TA-868, 337-TA-925, 337-TA-932, 337-TA-952, 337-TA-982, 337-TA-1004/990, 337-TA-1023, 337-TA-1026, and 337-TA-1053, all of which are related to the information and communications technology industry and public interest matters. I have significant experience in academia. I am a Senior Lecturer at the Massachusetts Institute of Technology (MIT) where I currently teach the business and engineering portions of the Integrated Design and Management program and have been responsible for creating, managing, and teaching two capstone leadership courses for postgraduate students, the Systems Leadership & Management Lab and Praxis programs, and for teaching the capstone leadership courses for undergraduates in the Gordon

Engineering Leadership program.[1] I am also a Principal Investigator at MIT and supervise the Master's thesis work of several students each year, much of which also focuses on issues related to mobile and digital ecosystems and innovation. I also have supervised theses that have been spun off as companies and received funding from the National Science Foundation.

13. I am responsible for organizing and teaching the New Technology Ventures program at London Business School, which is designed to enable would-be entrepreneurs to evaluate novel ideas and technologies, many of them in the mobile and digital industries, and turn them into new technology ventures. A primary focus of this course in particular is the economics of technological innovation, of new product introduction, and of entrepreneurial ventures.

14. I have held significant leadership roles in the industry. I was the New Zealand representative to the International Telecommunication Union Radiocommunication Sector (ITU-R), the international standards making body, including the ITU-R, Task Group 8/1. I was elected as a Vice-Chairman of the Global System for Mobile Communication Memorandum of Understanding (the largest group of mobile network operators worldwide, which is now the GSMA with nearly 800 members) and was a founder and Chairman of its 3rd Generation Interest Group, and have also chaired government working parties on PCS Spectrum.

15. I am the Chairman of the Massachusetts Technology Leadership Council Mobile Cluster, and I am on the Board of Advisors for the Department of Systems Engineering at the U.S. Military Academy at West Point, on the Board of Directors of the Kendall Square Association, and am an advisor to WGBH. I am a member of the Executive Committee of the

[1] Integrated Design & Management (IDM), MIT. (2017), http://idm.mit.edu/about/faculty/, (Last visited 2017.05.22), SS-ITC-AN-00125398.

Boston Area Chapter of the Communications Society of the Institute of Electrical and Electronic Engineers, and also a member of the Association for Computing Machinery, the Academy of Management, the Strategic Management Society, INFORMS, and the Product Development Management Association.

II. STATUS AS INDEPENDENT EXPERT

16. I have been retained in this matter by Samsung Electronics Co., LTD., Samsung Electronics America, Inc., and Samsung Research America to provide an analysis of the scope and content of U.S. Patent Application Publication No. 2013/0028192 A1 (hereinafter "the '192 Patent Application") (which is a U.S. counterpart to CN201010146531), U.S. Patent Application Publication No. 2009/0303956 A1 (hereinafter "the '956 Patent Application") (which is a U.S. counterpart to CN201110264130), and CN100571106C (which issued from CN200610058405) relative to the state of the art at the time of the earliest application for each application.

17. I have been retained to provide an analysis regarding the level of ordinary skill in the art at the time of invention of the '192 Patent Application, '956 Patent Application and CN100571106C, and what a person of ordinary skill in the art would have understood of the available non-infringing alternatives at the time of the earliest application underlying each patent.

18. I have also been retained to provide an analysis regarding the technical similarities of five Unwired Planet patents (EP2229744, EP2119287, EP2485514, EP1230818, EP1105991) and the six remaining Samsung patents (USRE44105, US8619726, US8761130, US8509350, US9288825, US9113419).

19. All of the opinions stated in this report are based on my own expertise and professional judgment.

20. I am being compensated at the rate of $800 per hour for my work. My fee is not contingent on the outcome of any matter or on any of the technical positions explained or set forth in this declaration. In preparing my report, I have considered the information cited herein and in Exhibit 2, along with other publicly available materials that I have reviewed.

III. ON THE NATURE OF STANDARD ESSENTIAL PATENTS AND ANTITRUST

21. I have been asked to examine several patents and to determine whether or not there were technically feasible alternatives that could have been chosen as the basis for the relevant standard. I have reviewed each of these patents, identified the key mechanisms of concern, and I have considered whether a person of ordinary skill in the art could have readily identified alternative approaches that met the same requirements. I have also looked at other relevant prior art from the related fields, in particular wireless communications, with which a person of ordinary skill would have been familiar, and wherein when confronted with analogous problems alternative approaches have been implemented. I have reviewed, where available, LTE patents describing alternative approaches that were proposed by other parties for the LTE standard.

22. Organizations within an industry may cooperate to create a standard. As part of participating in the standards-making process, each of these organizations makes a commitment that any patents which are essential to the standard, so called standard essential patents (SEPs), shall be licensed to other entities on a fair, reasonable, and non-discriminatory (FRAND) basis.

23. As these organizations work on developing and implementing the standard, any individual member organization of the standards body may file patents. If a member believes, and wishes to assert, that the invention(s) described in one of their patents must be used in order to properly implement the standard, it declares the patent to be standard essential with respect to

that particular standard. The standards body keeps a record of every patent that is declared by each of its constituent members to be standard essential.

24. There are several reasons why a patent that is declared to be standard essential may be found to be non-essential. For instance, it may be found upon thorough review that a patent which has been declared an SEP is only applicable to some implementations or embodiments of the standard. For example, if one of a company's patents deals with TDD mode, but TDD mode is only one of a plurality of possible implementation options within the standard, the patent would be found to be non-essential due to the fact that the standard may be successfully implemented without using the patent at all (e.g. perhaps the standard also supports FDD mode).

25. Generally, the value that a company is entitled to recover for an SEP is equal to the value that the patent held prior to it becoming incorporated into the standard. The reason for this is simple. It is generally understood that in many cases there are a number of feasible alternative ways of satisfying the requirements of the standard. Each of these alternatives has the same value prior to the selection of one to be adopted into the standard. Once the selected patent has been incorporated into the standard, anyone using the patent in implementing the standard must pay royalties for it on a Fair, Reasonable, and Non-Discriminatory ("FRAND") basis. At this point, the value of that particular patent is much higher than the value of the patents or inventions that were not selected for adoption into the standard.

26. A key difference arises when there is objectively only one feasible way of satisfying the requirements of the standard. In this case, the patent would be called "fundamental," as there are no acceptable alternative implementations. For example, the only way to meet the design requirements for LTE with low latency, high bandwidth, and high coding

efficiency is to use orthogonal frequency-division multiplexing (OFDM). Other schemes like code-division multiple access (CDMA) cannot be used, for reasons including some issues related to mobility management.

27. Such considerations related to essentiality and standardization need to be factored into any antitrust position. If a patent holder holds patents of the type where there were a number of credible alternative implementations prior to a single implementation being selected for incorporation into the standard, the patent holder would be in violation of antitrust regulations by asking for an injunction. While the holder asserts that their patent is standard essential, in reality it was perhaps arbitrarily selected from a pool of other equally feasible and applicable implementations. In this case, the patent holder's behavior is also inconsistent with the commitments they have made with the standards body. A holder should not be granted an injunction on a patent ex-post if the patent was only one of a number of equally plausible alternatives ex-ante.

IV. LEVEL OF ORDINARY SKILL IN THE ART

28. I have been told by counsel that "a person of ordinary skill in the art" ("POSITA") is a hypothetical person to whom an expert in the relevant field could assign a routine task with reasonable confidence that the task would be successfully carried out. I have been informed that the level of skill in the art is evidenced by the prior art references.

29. I am informed, and it is consistent with my review, that the earliest priority date for the '192 Patent Application is its April 7, 2010 priority date. The prior art discussed herein demonstrates that, at the time the '192 Patent Application was filed, a person of ordinary skill in the art would have had at least a bachelor's degree in electrical engineering, computer engineering, or computer science, with at least two to three years of experience in

telecommunications and networking, or an equivalent degree and/or experience. Superior education would compensate for a deficiency in experience, and vice-versa.

30. I am informed, and it is consistent with my review, that the earliest effective priority date for the '956 Patent Application is its April 29, 2008 priority date. The prior art discussed herein demonstrates that, at the time the '956 Patent Application was filed, a person of ordinary skill in the art would have at least a bachelor's degree in electrical engineering, computer engineering, or computer science, with at least two to three years of experience in telecommunications and networking, or an equivalent degree and/or experience. Superior education would compensate for a deficiency in experience, and vice-versa.

31. I am informed, and it is consistent with my review, that the earliest effective priority date for the CN100571106C Patent is its March 22, 2006 priority date. The prior art discussed herein demonstrates that, at the time CN100571106C was filed, a person of ordinary skill in the art would have at least a bachelor's degree in electrical engineering, computer engineering, or computer science, with at least two to three years of experience in telecommunications and networking, or an equivalent degree and/or experience. Superior education would compensate for a deficiency in experience, and vice-versa.

32. Based on my experience, I have an understanding of the capabilities of a person of ordinary skill in the relevant field. During the relevant timeframe, I have supervised, directed, and instructed many such persons over the course of my career.

V. AVAILABILE NON-INFRINGING ALTERNATIVES

A. U.S. Patent Application Publication No. 2013/0028192 A1

1. Summary of the '192 Patent Application

33. U.S. Patent Application Publication No. 2013/0028192 A1, *Method, user equipment and base station for transmitting uplink control information*, with a priority date of

April 7, 2010, is the U.S. counterpart to CN201010146531. The '192 Patent Application details a method and apparatus (user equipment and base station) for transmitting Uplink Control Information (UCI) in an LTE-A system using carrier aggregation. Carrier aggregation is the practice of combining the frequency spectrum of two or more component carriers to obtain a larger bandwidth. During carrier aggregation, user equipment utilizes multiple component carriers to communicate with a base station. Each of the component carriers has its own Uplink Control Information (UCI). The UCI of each component carrier in an LTE-A system using carrier aggregation is jointly coded with the UCI from multiple other component carriers, making it more difficult for a base station to correctly decode the UCI. The present invention proposes a common method of estimating the number of bits after jointly coding the UCI of the aggregate downlink carriers, so that the base station and the user equipment have a shared understanding of the original number of UCI bits and the base station can correctly decode the UCI. Moreover, the '192 Patent Application proposes sorting the UCI of each downlink carrier of the aggregate downlink carriers according to a preset sorting rule, so that the base station can determine the UCI corresponding to each downlink carrier.

34. Carrier aggregation features multiple downlink carriers, unlike single carrier mode of operation where there is only one downlink carrier. In carrier aggregation, user equipment updates a downlink activated carrier set according to carrier activation or deactivation commands it receives from a base station on a downlink sub-frame.

35. Each downlink carrier of the downlink activated carrier set has its own unique Uplink Control Information (UCI) that must be transmitted from the user equipment to the base station. Uplink Control Information (UCI) may be Channel State Information (CSI) like Channel Quality Information (CQI), Precoding Matrix Indicator (PMI), or Direct channel state

information or it may be Hybrid Automatic Repeat Request (HARQ) Acknowledgement information (ACK/NACK).

36. The user equipment sorts the UCI corresponding to each downlink carrier in the downlink activated carrier set according to a preset sorting rule. The preset sorting rule may be based on increasing or decreasing order of attributes (carrier index or carrier frequency) of the downlink carriers or the activation sequence of the downlink carriers. When activation sequence is used to sort downlink carriers and two or more downlink carriers are activated at the same time, then the preset sorting rule is based on increasing or decreasing order of attributes (carrier index or carrier frequency).

37. In order to transmit the complete sorted UCI (i.e. all of the pieces of UCI corresponding each of the downlink carriers sorted in the downlink activated carrier set) from the user equipment to the base station, the pieces of UCI are jointly channel coded onto a physical channel. Once the sorted UCI have been jointly channel coded the user equipment uses a prescribed calculation to devise the length (i.e. the number of bits) of the UCI after channel coding and then transmits the jointly channel coded UCI.

38. The base station then receives the jointly channel coded UCI and uses the same prescribed calculation as the user equipment to determine the length (i.e. the number of bits) of the UCI after channel coding and then decode the UCI message. Both the user equipment and the base station use the same prescribed calculation to calculate the number of bits of UCI after channel coding, which ensures they will calculate the same length and as a result, the base station can properly decode the UCI.

39. Moreover, using the same preset sorting rule the user equipment used to sort the pieces of UCI prior to coding and transmission, the base station can decipher (from the order in which they were sent) which piece of UCI is associated with each downlink carrier.

40. The base station and user equipment use the same predefined rules for sorting UCI and the same method for calculating the length (number of bits) of the channel coded UCI, which enables the base station to be able to properly decode the channel coded UCI transmission and to know which piece of UCI is associated with each downlink carrier.

41. Transmitting UCI in an LTE-A system with carrier aggregation can be thought of as being analogous to sending a letter to multiple addressees in multiple languages. In the implementation of the '192 Patent Application, the sender (user equipment) has a number of letters each associated with a different address (downlink carrier) and a different language (UCI) and wants to send a single package containing these letters to the receiver. Prior to placing the letters in a single package (physical channel), the sender sorts the letters according to an attribute of the address (downlink carrier), say the alphabetical order of the first names of the addressees according to an agreed upon ordering mechanism. Once the letters are sorted, they are placed in the package (i.e. channel coded) and the sender calculates the number of letters (i.e. the length of the UCI after channel coding) in the package by weight using an agreed upon equation and a calibrated scale. The sender then sends the package. The receiver receives the package with the letters and uses the same scale and agreed upon equation to calculate how many letters are in the package by weight. In this way, the receiver and the sender have a shared understanding of how many letters are in the package, and the receiver can confidently remove (decode) the letters from the package knowing it has all of them. The receiver then uses the preset sorting rule to

decipher which language (UCI) is associated with a given address (downlink carrier) based on the order in which the letters are sent.

2. Key Elements of the '192 Patent Application

42. According to '192 Patent Application, prior to the invention it put forth base stations incorrectly decoded the jointly coded UCI they received from the user equipment, because the base station and user equipment lacked a common understanding of the number of bits of the original UCI after coding. The '192 Patent Application proposes an alternative method by:

> *Establishing a common understanding of the length of the message between the user equipment and the base station.*

43. The '192 Patent Application asserts that prior to the invention it put forth, base stations lacked a way of identifying which piece of UCI corresponded to a particular downlink carrier. The '192 Patent Application proposes to solve this problem by:

> *Organizing the information to be transmitted in such a way that the receiver can determine which piece of information corresponds to each carrier*

3. Person of Ordinary Skill in the Art (POSITA) Alternatives

44. There exist many alternatives for transmitting UCI in an LTE-A system with carrier aggregation presented in the '192 Patent Application, all of which would have been well understood and deemed plausible by a person of ordinary skill in the art at the time of the filing date. For instance, many alternatives existed to the element of the '192 Patent Application that holds that a common understanding of the length of the UCI after channel coding must be established between the user equipment and the base station, to ensure the base station correctly decodes the jointly coded UCI in an LTE-A system with carrier aggregation. Additionally, many alternatives existed to establish the correspondence between a piece of UCI and a downlink carrier beyond the sorting of the UCI pieces according to a preset sorting rule.

a. Labeling

45. A POSITA would have known that a plausible alternative to establishing a common understanding of the length of UCI after channel coding between the user equipment and the base station would have been to label each of the pieces of UCI with a number, as well as an indication of how many total pieces of UCI are contained in the activated downlink carrier set. The labeling methodology has many benefits. For one, it would obviate the need of the base station and the user equipment to calculate the number of bits of UCI after channel coding. This methodology would also ensure that the base station understood how many UCI pieces it should receive. If the base station did not receive the expected number of UCI pieces, it could identify the missing piece and request that it be retransmitted.

46. Additionally, a POSITA would have known that a plausible alternative to sorting each piece of UCI according to a preset sorting rule to decipher which piece of UCI was associated with which downlink carrier, each piece of UCI could be labeled with information about the downlink carrier it belonged to. The labeling methodology is much more explicit than sorting according to a preset sorting rule laid out by the '192 Patent Application, as it has a 1:1 correspondence and does not rely on rules which may have exceptions or be misinterpreted.

b. Preamble

47. A POSITA would have known that a plausible alternative to establishing a common understanding of the length of UCI after channel coding between the user equipment and the base station would have been to affix a preamble to the jointly channel coded UCI describing how many total pieces of UCI are contained in the activated downlink carrier set. The preamble methodology has many benefits, for one it would obviate the need of the base station and the user equipment to calculate the number of bits of UCI after channel coding. This methodology would also ensure that the base station understood how many UCI pieces it should

receive. If the base station did not receive the expected number of UCI pieces, it could request that a missing piece be retransmitted (though unlike the labeling alternative, the base station would not know explicitly which UCI piece was missing, only that a UCI piece was missing).

48. Additionally, a POSITA would have known that a plausible alternative to sorting each piece of UCI according to a preset sorting rule to decipher which piece of UCI was associated with which downlink carrier, would be affixing a preamble to the jointly channel coded UCI describing the relationship of each piece of UCI to each downlink carrier. The preamble methodology is more explicit than sorting according to a preset sorting rule laid out by the '192 Patent Application, but less explicit than the labeling, as it only establishes the correspondence between the pieces of UCI and downlink carriers at the beginning of the jointly channel coded UCI message.

c. Look-Up Table

49. A person of ordinary skill in the art would have known that a plausible alternative to sorting each piece of UCI according to a preset sorting rule to decipher which piece of UCI was associated with which downlink carrier, would be to have a base station reference a look-up table to decipher the relationship of each piece of UCI to each downlink carrier. The reference table method is much more explicit than sorting according to a preset sorting rule laid out by the '192 Patent Application, as it establishes a 1:1 correspondence between the pieces of UCI and downlink carriers. The look up table methodology would not increase the overhead associated with the jointly coded UCI.

d. Stop Message

50. A person of ordinary skill in the art would have known that a plausible alternative to establishing a common understanding of the length of UCI after channel coding between the user equipment and the base station would have been to affix a stop message at the end of the

jointly channel coded UCI. The stop message methodology has many benefits. For one, it would obviate the need of the base station and the user equipment to calculate the number of bits of UCI after channel coding. This methodology would also have a relatively low overhead as it would involve merely adding one short stop message at the end of the jointly channel coded UCI.

4. Patent Alternatives

51. The US20110242997A1 Patent Application Publication ("the '997 Patent Application"), *Extended uplink control information (UCI) reporting via the physical uplink control channel (PUCCH)*, with a priority date of April 2, 2010 discloses the use of bits at the beginning of the UCI message, these bits correspond to a symbol. The symbol is then used encode the UCI, which can then be sent to the base station, and the base station could use the symbol to decode the UCI message. A POSITA would understand that the '997 Patent Application is an alternative means of transmitting UCI, where a symbol is used to ensure the base station decodes the UCI properly instead of the number of channel coded bits of UCI.

52. A POSITA would understand that the below claim lays out an alternative to the calculations set out in the '192 Patent Application. Rather than encoding and decoding the UCI based calculations performed prior to transmission and upon reception by the base station, the '997 Patent Application details the use of symbols to encode the UCI. This would involve an agreement by both the user equipment and base station on the meaning of each symbol used to encode the UCIs, likely stored in a lookup table. This would reduce the calculation overhead on both the uplink and downlink.

> *Claim 1: A method for reporting uplink control information (UCI), comprising: encoding a first part of the UCI in a single physical uplink control channel (PUCCH) symbol; selecting a channel of the PUCCH symbol to implicitly encode a second part of the UCI in the PUCCH symbol; and transmitting the PUCCH symbol via a single PUCCH signal.*

53. The '997 Patent Application details the use of a table to determine the applicable symbol for a UCI when encoding the UCI, which allows the message being transmitted to be significantly smaller. By only encoding the first bit or first and second bit, and then encoding that to a symbol, the message is simplified and therefore rendered smaller and easier to transmit in the PUCCH. Furthermore, this method would allow for the determination of the UCI payload size, and thus the means and channel by which the symbol should be generated, and the message delivered. A POSITA would understand that this system allows for extended UCI payloads, providing the necessary channel flexibility to accommodate the more complex UCI messages, while ensuring that the benefits from symbol encoding are maintained at both the extended and non-extended payload sizes, and would be a sufficient alternative to the '192 Patent Application.

> *Paragraph [0015]: The PUCCH symbol may be configured for uplink signaling. A number of coded UCI bits for implicit transmission may be determined using channel selection. Selecting a channel of the PUCCH symbol may include generating a first bit or the first bit and a second bit of the coded UCI bits using a table. The first bit or the first bit and the second bit may be transmitted in the PUCCH symbol.*
>
> *Paragraph [0016]: The table may be a sample mapping table. The first bit or the first bit and the second bit may be transmitted by selecting the corresponding PUCCH resource index. The PUCCH symbols may be generated from another or the same set of the first bit or the first bit and the second bit with binary phase shift keying (BPSK) or quadrature phase shift keying (QPSK) modulation.*
>
> *Paragraph [0017]: A UCI payload size may be determined. It may also be determined whether the UCI payload size is an extended UCI payload size. The PUCCH symbol may be generated using a symbol level extended channel selection mechanism if the UCI payload size is an extended UCI payload size. It may be determined whether an extended channel selection format is used for a Release-8 payload if the UCI payload size is not an extended UCI payload size. The PUCCH symbol may be generated using Release-8 PUCCH formats if the UCI payload size is not an extended UCI payload size and the extended channel selection is not used for a Release-8 payload. The PUCCH symbol may be generated using a symbol level extended channel selection mechanism if the extended channel selection is used for a Release-8 payload.*

54. The CN102282819A Patent Application ("the '819 Patent Application"), *Multi-carrier wireless communication system and a transmission method of an uplink control information link means*, with a priority date of January 13, 2009, describes a method by which the user equipment uses the number of channel coded UCI bits to decide whether to divide UCI transmission over multiple Physical Uplink Shared Channels. This base station uses the same method as the user equipment to determine the number of channel coded UCI bits as a basis for decoding the channel coded UCI. A person of ordinary skill in the art would have noticed that the '819 Patent Application and the accused '192 Patent Application both disclose a base station and user equipment using an identical calculation to determine the number of channel coded UCI bits which in turn enables the base station to decode the channel coded UCI.

55. Claim 6 puts forth an approach of delivering UCI messages which allows for the messages to be segmented and delivered over a plurality of channels, rather than on a single channel. This differs from the '192 Patent Application in that rather than delivering the UCI in a single channel and associating the UCI for each carrier by ordering, the UCI corresponding to each carrier is based on the channel used to deliver the UCI for each carrier. Furthermore, by utilizing multiple channels, the transmission is not bound by the capacity of single channel, allowing more flexibility in communicating with the base station.

> *Claim 6: A supporting uplink transmission in a wireless multi-carrier communication system, control information (UCI) transmitting apparatus, comprising: a transmission controller, which calculates the number of bits to be transmitted to the UCI; at least one channel encoder for under the control of the transmission controller performs channel coding UCI; at least one divider, which is a plurality of physical uplink shared channel (PUSCH) dividing the channel-coded UCI; PUSCH transmission and at least one unit, and as many as the number of carriers, for multiplexing by dividing the data obtained with the UCI and transmit UCI and data multiplexed on the PUSCH.*

56. A POSITA would understand that the calculation discussed in claim 9 is an alternative to the calculation outlined in the '192 Patent Application. The method in claim 9

details the use of an identical calculation employed to encode the UCI by the user equipment to decode the UCI at the base station. The calculation is used to determine the number of UCI bits in each channel used to transmit the UCI information, combine the parts of the message from the various delivery channels, and to decode the now combined message. This ensures that the base station can successfully decode the encoded UCI.

> *Claim 9: A supporting uplink transmission in a wireless multi-carrier communication system, control information (UCI) receiving method, comprising: calculating for each physical uplink shared channel (PUSCH) the number of bits of the UCI Qk; PUSCH from each extracting corresponding bits coded UCI of Qk; UCI bits and the combination of decoding coded UCI.*

B. U.S. Patent Application Publication No. 2009/0303956 A1

1. Summary of the '956 Patent Application

57. U.S. Patent Application Publication No. 2009/0303956 A1, *Method, device and system for assigning ACK channels to users,* with a priority date of April 29, 2008 is the U.S. counterpart to CN201110264130. The '956 Patent establishes means to assign acknowledgement (ACK) channels to users using one uplink sub-frame through a plurality of downlink subframes to maximize efficiency and free up previously unavailable ACK channels.

58. The inventors of the '956 Patent Application asserts the presence of limitations in the channel allocation schemes in the prior art. The asserted schemes in the prior art would lead to fragmentation of ACK channels at the sub-frame level. By employing an implicit 1:1 mapping of Control Channel Elements (CCEs) to ACK channels, the asserted prior art would in some cases render significant portions of the uplink resources potentially unusable upon release. The asserted channel allocation schemes in the prior art was liable to sequence its ACK/NACK messages (in the uplink direction) in such a way that once groups of ACK channels were no longer needed, and therefore released, they could not easily be reformatted and reused because they were often shorter than a whole resource block (RB). Many critical transmissions cannot be

sent unless network resources can be provisioned in the appropriate block sizes. The '956 Patent Application proposes an alternative to this asserted problem through a method and a device.

59. The method of the '956 Patent Application involves dividing ACK channels into a number of sub-blocks. Each ACK channel is then assigned by mapping to the block/sub-block hierarchy, first in order of increasing block level (label d) and then in order of increasing sub-block level (label m). In this scheme, groups of CCEs within the same sub-frame are mapped to different sub-blocks.

60. Under this scheme, the release of individual ACK channels frees sections of network resources that can easily form whole RBs that allow for potential transmission on other channels such as the Physical Uplink Share Channel (PUSCH).

61. The device described in the '956 Patent Application is made up of a reservation unit and an assignment unit. The reservation unit is configured to reserve channels for N downlink sub-frames. The assignment unit is configured to divide the reserved ACK channels into N blocks through the process of mapping one block (label d) and the plurality of sub blocks (label m) according to a sequence of increasing the mapping label of d first then m. The device is located at a network side and configured to assign ACK channels to the UE thus allowing the UE to feedback ACK information of N downlink sub-frames to the network side on these ACK channels.

2. Key Elements of the '956 Patent Application

62. Upon asserting the nature of the channel allocation schemes in the prior art, the inventors propose a dynamic allocation scheme that they felt would make more efficient use of network resources in the time domain (sequence messages more intelligently, prevent fragmentations, etc.).

63. The present invention of the '956 Patent Application, can perhaps best be understood through an analogy. Consider the following scenario. A businesswoman has five items to pack in her work bag. She packs them sequentially, one at a time, without much care as to the order in which they are placed or how they are positioned within the bag. She goes to work, and when she gets there she takes out two of the items from her bag and places them on her desk where they belong. The woman's boss gives her a new item, perhaps a big stack of papers to read. She needs to place this stack of papers in her bag and carry it home to read overnight. When she tries to fit the stack of papers in her bag, she realizes that it is almost impossible to do so. She further realizes that this difficulty has arisen from the fact that while the total vacant space left behind by the removal of the two items she left on her desk should in theory be large enough to allow her new item to fit, the way in which this free space is distributed broadly throughout her bag makes it difficult to combine that space into one single spot in which to fit the stack of papers. The woman is faced with two options: either (1) bring the stack of papers home another night when it is easier to fit the papers in her bag, or (2) find a way to reorganize her bag in such a way that the free space inside can be pooled into one location large enough to fit the stack of papers.

64. In the context of the '956 Patent Application, the volume (or space) inside the woman's bag is analogous to the pool of network resources available. The items the woman packs inside her bag are the transmissions that need to be sent, and the sections of space within the bag that she reserves for each of these items represent individually allocated channels. The woman's packing strategy is the channel allocation scheme. When she removes an item from her bag and sets it on her desk this is analogous to releasing a channel, as she has emptied a previously reserved section of her bag of the item (or transmission) that occupied it. When she

takes out two items and sees that packing her new stack of papers will be difficult, this is analogous to the problem that the inventors were motivated to solve. In the prior art, channel allocation schemes were often not flexible to the way in which communications requirements changed over time. Just as it is difficult for the woman to fit her new stack of papers in her bag even though she has removed two other items, these older channel allocation schemes made it difficult for network resources freed by channel release to be recycled on short order because the segments of time assigned to each transmission (in units of sub-frames) were distributed inefficiently. If one had to send a new transmission but two recent channel releases did not, either individually or in combination, afford them enough freed network resources through which to transmit, they would have either had to (1) wait longer for more network resources to be freed up, or (2) invent a different channel allocation scheme that would allow them to more effectively pool recently released network resources for efficient reuse. The inventors of the '956 Patent Application chose the second option.

65. If the woman took option 2 in solving her bag-packing dilemma, she would be wise to invent a new packing strategy that would be dynamic and flexible to a wide range of future packing scenarios. She would be incentivized to create a strategy in which unpacking one or more items creates space that is readily usable for other key items she may wish to pack. The inventors of the '956 Patent Application did just this. The block/sub-block channel allocation hierarchy and the rules surrounding its use ensure that the release of a channel results in the freeing of whole resource blocks that can be readily used for new transmissions.

3. Person of Ordinary Skill in the Art (POSITA) alternatives

66. There exist many alternatives to the ACK channel allocation scheme presented in the '956 Patent Application, all of which would have been well understood and deemed plausible by a POSITA at the time of the filing date.

a. Extremes

67. A POSITA would have known that a plausible alternative channel allocation method would have been to map channels to available sub-frames by alternating between extremes in the time domain. That is, channels would be positioned in time in an alternating fashion between the earliest available position and the latest available position. In this scheme, any channels allocated to a group of frames would exist at the temporal boundaries, leaving all additional free blocks in the temporal center of the group. Such a method could be made robust to most arbitrary channel release scenarios by allocating the necessary channels in a particular order. For example, the channels to be mapped to the available network resources could first be ranked according to their CCE length. The channel demanding the most network resources would be allocated first, at the earliest position. Next, the shortest channel would be allocated at the last possible position. The second-most resource-intensive channel would be allocated next and be placed directly after the first channel, at the earliest position available. The second-shortest channel would be allocated next in the latest available position, and so on. Once again, any free resources will be pooled between the earliest and latest blocks of channels. Additionally, this temporal distribution of channels according to size will increase the probability that any given channel release will result in the clearing of usable blocks. The free resource pool initially restricted to the temporal center will be adjacent to the two channels closest to the median channel CCE length. Assuming for example the probability of any given channel release being equal, this configuration increases the expected value of the number of frames, and therefore resource blocks, that will be formed in contiguity to the central pool of free network resources upon any given release. This allocation scheme essentially tries to pool as many free resources as possible up-front and hedges against fragmentation risk by separating the most resource-intensive channels from the least resource-intensive channels in the time domain.

68. This is analogous to packing a suitcase by starting at the sides, leaving a space in the center open to accommodate anything you might pack later while also being careful to group the larger items together at one end and the smaller items together at the other end. If anything is removed from the suitcase, the chances that the space left empty by such a removal is contiguous to the free space in the middle is maximized. As a thought exercise, consider an alternative where the free space is initially pooled at either extreme of the group of available frames. In this scenario there is only ever 1 in N chances that a given channel release will occur adjacent to the free block, where N is the total number of channels allocated within the group of frames. By pooling the initial free resources in the temporal center, the free blocks are guaranteed to be adjacent to not one but two allocated channels, doubling the probability that any given channel release will occur immediately next to the free space in the center. Contiguous free blocks can easily be formed into RBs to be used for additional transmissions.

b. Symbols

69. In another alternative method, a POSITA would have known that multiple ACK/NACK messages related to downlink sub-frames could be combined and sent on a single uplink channel if the control information is placed in a single data stream and then multiplexed with a user data stream using a modulation scheme such as phase-shift keying. In such a system, individual bits of control information and user data can be combined and simplified into symbols, also sometimes called constellations, that encode information from two separate data streams. The network can receive the symbol and decode it into the original two streams of data. The suitcase-packing analogy for this system is quite unusual. Essentially, combining two data streams into a stream of symbols on one channel via phase-shift key modulation is analogous to taking all of the contents from two suitcases and fitting these contents into a third suitcase of similar size. The novelty of phase-shift keying is that it essentially acts as a data rate multiplier.

For instance, binary phase-shift keying (BPSK) allows twice as much data to be transmitted per symbol as a would be transmitted on a normal, unmodulated channel. Similarly, quadrature phase-shift keying (QPSK) achieves twice the data rate of BPSK. Combining ACK/NACK transmissions with user data and phase-shift key modulating the allocated resulting channel succeeds in improving network resource utilization and efficiency, albeit in a very different way than the method of the '956 Patent Application.

4. Patent Alternatives

70. The US 2010/0322114 A1 Patent Application Publication ("the '114 Patent Application"), *Method of allocating uplink ACK/NACK channels*, with a priority date of April 2, 2008, outlines a method for allocating uplink ACK/NACK channel indexes through the binding of CCE indexes in one sub-frame and in a plurality of sub-frames in one uplink sub-frame. Through this method, a CCE with a minimum index in a PDCCH is bound to ACK/NACK channels with less index values while other CCEs are consequently bound to ACK/NACK channels with greater index values, thus creating an effective channel allocation scheme. The implementation of a circular offset in the channel allocation scheme, as outlined by the inventors, guarantee that individual PDCCHs of a particular size are mapped to different channels.

71. A POSITA would understand that the circular offset is tasked to ensure ACK/NACKs are allocated to different channels through the identification of different sized of PDCCHs. Because of this, the '114 Patent Application differs from the '956 Patent Application where instead of a channel allocation scheme being prioritized by the hierarchical division of blocks and sub-blocks, the '114 Patent Application proposes a method of implementing a circular offset in the channel allocation scheme that guarantees individual PDCCHs of a particular size to be mapped to different channels. This offers an alternative method of mapping ACK/NACK channels with the effect of increasing efficiency in a one uplink-subframe.

> *Paragraph [0071]: In order to solve this problem, present invention provides a method in which one circular offset η is added when CCEs are mapped to one ACK/NACK repeatedly. Here, η is used for ensuring that all PDCCHs with 2-CCE (or 4-CCE, or 8-CCE) are mapped to different ACK/NACKs when the plurality of CCEs are mapped to ACK/NACKs.*

72. The US 2009/0285122 A1 Patent Application Publication ("the '122 Patent Application"), *Uplink control for time-division duplex with asymmetric assignment*, with a priority date of April 21, 2008, proposes an alternative method of allocating uplink ACK/NACK through a hybrid bundling structure aimed at furthering resource utilization efficiency and reducing overhead when it comes to the transmission of control data. The process involves the combination of multiple ACK/NACK transmissions that are bundled into one channel that would correspond to an uplink-downlink configuration of subframe assignments through a hybrid bundling module that transmits to the UE. A POSITA would understand that the '122 Patent Application proposes an alternative means of mapping ACK/NACK transmissions through the use of hybrid bundling as opposed to the binding of CCEs indexes or the division of CCEs into blocks/sub-blocks.

73. A POSITA would understand Claim 1 to be an alternative way to increase resource utilization efficiency and reduce overhead when it comes to the transmission of control data through the bundling of multiple ACK/NACK transmissions into one channel. The hybrid bundling structure is effectively communicated from the configuration unit to the UE is outlined as a means of executing this method of channel allocation.

> *Claim 1: A link configuration unit, comprising: a hybrid bundling module configured to provide a hybrid ACK/NACK bundling structure for an uplink ACK/NACK entity from user equipment, wherein the hybrid ACK/NACK bundling structure corresponds to an uplink-downlink configuration of subframe assignments; and a sending module configured to transmit the hybrid ACK/NACK bundling structure to the user equipment.*

74. The inventors of the '122 Patent Application outline the process of implementing a codeword to implement ACK/NACK bundling across sub-frames. A POSITA would understand that '122 Patent Application serves as an alternative in allocating ACK/NACK transmission through the decision to bundle across sub-frames in the time domain. As a result of this method, the inventors of '122 Patent Application attempt to make more efficient use of individual resource blocks.

> *Paragraph [0042]: FIG. 3 illustrates a first example of bundling for spatial multiplexing, generally designated 300, wherein four DL subframes and a bundling window length of two are assumed. Each bundle represents one ACK/NACK entity, and all DL subframes are assigned two spatial codewords. The first example of spatial multiplexing 300 includes first and second bundles 305, 310 for codeword one (CW1) and third and fourth bundles 315, 320 for codeword 2 (CW2). Note that each spatial codeword is associated with a distinct transport block.*
>
> *Paragraph [0043]: The ACK/NACK bundling is perform across sub-frames (i.e., in the time domain). Due to the support of dynamic rank adaptation for spatial multiplexing, the number of MIMO codewords (transmission layers) scheduled for each UE can vary within the bundles of DL subframes. When all the bundled DL subframes are assigned to more than one layer, each ACK/NACK entity consists of two bits with each corresponding to one codeword. Hence, the ACK/NACK bundling can be performed across subframes for each codeword.*

75. The KR20080096351A Patent Application Publication ("the '351 Patent Application"), *A method for transmitting control channel in a communication system*, with a priority date of April 27, 2007, outlines a method for transmitting a control channel in a communication system by mapping a virtual resource to a physical resource and using a block interleaver. According to the patent, individual control channel elements (CCEs) are grouped and then permuted within the group to conform to a predetermined pattern by an interleaver. The permuted CCEs are then mapped to the physical resource (or channel) and this mapped control channel is transmitted.

76. A POSITA would understand that the '351 Patent Application differs from the '956 Patent Application where instead of a dynamic channel allocation scheme being prioritized by the hierarchical division of blocks and sub-blocks, the '351 Patent Application proposes a static method of using an interleaver to combine a plurality of CCEs into a predetermined pattern.

> *Further, the method of transmitting a control channel in a communication system according to another embodiment of the present invention includes the steps of grouping the control channel elements, the phase of the at least one control channel element to be transmitted during one sub-frame subframe physical resource in comprising the step, and transmitting the mapped control channel element to map the distributed by the interleaver, in the mapping step, one control channel location and said at least one of within a resource element the control element channel by an interleaver at least one of each element position is characterized in that it is determined through a predetermined substitution process."*
>
> *"The substitution process can be used for cell-specific information, in addition, the interleaver may be a different block interleaver the input and output direction."*
>
> *"At this time, the method comprising the steps of: in one direction predetermined in the said block comprising: inputting the one or more control channel elements in a first direction in the column direction and the row direction of the interleaver, the first direction and the second direction with respect to the block interleaver performing a movement operation on the basis of the offset magnitude, wherein the phase and the block interleaver performing the substitution operation on the basis of the predetermined pattern in either direction of the first direction and the second direction with respect to the block interleaver the may further include at least one of a step of outputting at least one control channel element in the second direction."*

C. Chinese Patent No. CN100571106C

1. Summary of the CN100571106C Patent

77. Chinese Patent No. CN100571106C, *Wireless Network Communication Device*, with a priority date of March 22, 2006, issued from CN200610058405. The CN100571106C Patent pertains to two of the types of services supported by the Radio Link Control (RLC) in Release 7 of the LTE standard. These types of services are (1) Acknowledgement Mode (AM) service and (2) Unacknowledgement Mode (UM) service. The patent details how Release 7 of

LTE improves upon Release 6 with regards to the RLC particularly in regard to the AM and UM entity. One asserted improvement of Release 7, as detailed by the patent, is the fact that the RLC moved from being housed in a separate Radio Network Control entity to being incorporated into the base station where it now serves as either its own layer within the base station or as a combined layer with the Medium Access Control (MAC) layer (MAC+ layer). Another asserted advantage of Release 7 over Release 6, according to the CN100571106C Patent, is the fact that segmenting and concatenating can be based on flexible Protocol Data Unit (PDU) sizes which reduces padding and increases transmission efficiency. The final asserted advantage this patent discusses in regard to Release 7, is the ordered delivery of Service Data Units (SDUs) to the PDCP layer which reduces errors during head decompression.

78. The primary difference between AM and UM is that Acknowledgement Mode requires that all PDUs awaiting transmission must be acknowledged by a peer entity to decide whether or not to retransmit them. If an error is found with a PDU's initial transmission, then it would be retransmitted, whereas if there was no error in the PDU's initial transmission it would not be retransmitted.

79. The AM entity detailed in the '106C Patent is capable of transmitting and receiving PDUs. The transmitting side entity receives Service Data Units (SDUs) from a higher layer and processes them into Protocol Data Units (PDUs) that can be transmitted to the MAC layer. Processing of the SDUs begins when the SDUs are segmented (broken apart) and concatenated (combined) into PDUs by a segmenting and concatenating unit. The segmenting and concatenating unit also adds an RLC header to the resultant PDUs. The PDUs are then fed to a retransmission buffering unit where the PDUs await feedback from a peer entity on whether they should be retransmitted or not (based on whether there was an error found in their initial

transmission). Essentially, the retransmission buffering unit ensures that only incorrectly transmitted data is retransmitted. Those PDUs that are supposed to be retransmitted are then fed to a transmission buffering unit where they await transmission until the base station is ready to receive them. The transmission buffering unit provides flow control to prevent the base station from getting congested and ensures that fewer transmission errors are made. The PDUs ready for transmission are then encrypted and finally transmitted to the MAC sublayer through a logical channel. Before a MAC sublayer transmits a PDU it schedules, multiplexes, and determines the size of the PDUs based on the logical channel QoS and traffic QoS. Since the MAC transmits flexibly sized PDUs, segmenting and concatenating can be based on flexible PDU sizes which reduces padding and increases transmission efficiency.

80. The receiving side entity receives PDUs from the MAC sublayer and processes them into SDUs that can be transmitted to a higher layer. Processing of the PDUs begins when the PDUs are decrypted. The decrypted PDUs are placed into a retransmission managing unit where the PDUs await feedback from a peer entity on whether they should be re-transmitted or not (based on whether there was an error found in their initial reception, if no error is found they are discarded). Those PDUs that are supposed to be re-transmitted are then fed to a reordering buffer unit where they are ordered in sequence. Ordering the PDUs improves the processing speed of the base station. Then ordered PDU sequence is sent to the re-assembling unit for assembling the ordered PDUs into SDUs. Then the SDUs are transmitted to the upper layer.

81. The UM entity detailed in the '106C Patent is also capable of transmitting and receiving PDUs, though as mentioned earlier without the need for acknowledgement. The transmitting side entity receives SDUs from a higher layer and processes them into PDUs that can be transmitted to the MAC layer. Processing of the SDUs begins when the SDUs are sent to

the transmission buffering unit where they await further processing until the base station is ready. The transmission buffering unit provides flow control to prevent the base station from getting congested and ensures that fewer transmission errors are made. The SDUs are then fed to a segmenting and concatenating unit where they are segmented (broken apart) and concatenated (combined) into PDUs. After segmentation and concatenation, a RLC header is attached to the resultant PDUs by the RLC head adding unit. Then the PDUs are encrypted for transmission to the MAC sublayer. Before a MAC sublayer transmits a PDU it schedules, multiplexes, and determines the size of the PDUs based on the logical channel QoS and traffic QoS. Since the MAC transmits flexibly sized PDUs, segmenting and concatenating can be based on flexible PDU sizes which reduces padding and increases transmission efficiency.

82. The receiving side entity receives the PDUs from the MAC sublayer and processes them into SDUs that can be transmitted to a higher layer. Processing the PDUs begins when the PDUs are decrypted. The decrypted PDUs are then placed in a reception buffering unit where they await to be transmitted. Once the PDUs are ready for transmission, they are fed to a RLC head removing unit to remove their RLC header. Then the PDUs are sent to the reassembling unit for assembling the PDUs into SDUs, and then the SDUs are finally transmitted to the upper layer.

2. Key Elements of the CN100571106C Patent

83. The inventors of the '106 Patent propose to increase the utilization of network resources and in doing so attempt to improve quality of service for users. The inventors assert that previous systems were limited by their inability to package SDUs into PDUs of variable length. That is, previous systems are asserted to be seriously constrained in their ability to pass data between protocol layers without needing to append "padding" to smaller data units in order to lengthen them to an amenable size. For example, if an SDU from protocol layer N+1 were

quite small, older systems would need to append a header and potentially some additional padding in order to be able to package said SDU into a PDU for delivery to the next lowest layer, layer N. This problem existed because the system was only able to handle PDUs of a particular size. The inventors propose an alternative method by enabling the system to handle PDUs of variable size. This eliminates the need for higher layers to pad SDUs with filler in order to construct a PDU of a predetermined size that can be passed to the layer below. As a result, the method stated in the '106 Patent calls for network resources to be more efficiently allocated, leading to lower traffic and a higher quality of service for the users.

84. The data unit packaging problem that the inventors of the '106 Patent encountered can be understood through the following analogy. A man is moving from his old place of residence to a new apartment, and he is in the process of packing all of his belongings. When he is done boxing all of his items, he contacts a rental van company to acquire a vehicle for transporting his belongings. The rental company only has one type of vehicle available – a rather large van with considerably more space than he needs. What is more, the rental company has a non-negotiable policy stating that any mover must be able to fill the entire storage volume in order to rent and use the vehicle. Since the man does not have enough belongings to fill the entirety of the space inside the moving vehicle, he has two options; (1) find miscellaneous materials to fill in the voids left after packing all of his belongings into the van, or (2) find another rental company that either has a fleet of vehicles with different storage capacities or does not require the mover to fill the entire storage volume of any given vehicle.

85. In this analogy, the man's old place of residence is a higher protocol layer, and the new apartment he is moving to is the layer below this. The man's belongings are an SDU, and his belongings together with the moving vehicle represent a PDU. When the man is unable

to use the rental company's vehicle without adding extra miscellaneous items into the storage space, this is analogous to the way in which the old system of Release 6 was only able to handle PDUs of one particular size and so would require SDUs to be appended with padding in order to reach that prescribed size. Just as adding filler material in the back of the rental vehicle would waste the man's energy and the rental company's resources, the process of adding padding to short SDUs in Release 6 in order to attain an acceptable PDU length resulted in a waste of system processing as well as network resources. The extra space in the moving vehicle would essentially go to waste, as would the extra space in the PDU that is occupied by the padding's arbitrary and miscellaneous data. Speaking again in terms of this analogy, the inventors of the '106 Patent chose to create another rental company by allowing movers to rent any size vehicle that will accommodate their belongings. The vehicle does not need to be any larger than what the mover needs, and there are no boundary conditions constraining the ability of a mover to rent a vehicle based on payload.

3. Person of Ordinary Skill in the Art (POSITA) alternatives

a. Small PDUs

86. The '106 Patent maintains that the portions of LTE Release 7 it contributed to attempt to improve upon LTE Release 6. One of these improvements is flexible PDU sizes. Prior to transmitting a PDU, the MAC sublayer determines the size of the PDUs based on the logical channel QoS and traffic QoS. This in turn dictates the size of PDUs the segmenting and concatenating unit should produce. According to the patent, flexible PDU sizes enable segmenting and concatenating to be performed with less padding, which in turn increases transmission efficiency. A POSITA at the time of the patent filing, would have been able to identify alternate means of decreasing the amount of padding required during segmenting and concatenating SDUs to PDUs. One particular method that would have occurred to a POSITA is

limiting the size of PDUs to very small PDUs, as if the PDUs were sufficiently small they could be segmented and concatenated without any padding, in fact it would be likely that the SDUs would have to be segmented (broken apart) to fulfill the PDU size requirement.

b. Ordering

87. Another advantage the '106C Patent discusses in regard to its contributions to LTE Release 7, is the ordered delivery of SDUs to the PDCP layer which reduces errors during head decompression. The patent accomplishes this by using a reordering buffering unit to ensure the SDUs are sent to the PDCP in the appropriate order. A POSITA at the time of the patent filing, would have been able to identify alternate means of reducing head decompression errors. One particular method that would have occurred to a POSITA is having a MAC layer schedule its PDU transmissions according to the exact order.

VI. TECHNICAL SIMILARITIES BETWEEN THE UNWIRED PLANET AND SAMSUNG PATENTS

88. I have been asked to opine on the technical comparability of five Unwired Planet patents (EP2229744, EP2119287, EP2485514, EP1230818, EP1105991) (collectively, "Unwired Planet Patents") and the six remaining Samsung patents in this case (USRE44105, US8619726, US8761130, US8509350, US9288825, US9113419) (collectively, "Samsung Patents").[2]

89. Upon review of these patents and publicly available information about them, I have found that the Unwired Planet and Samsung Patents are broadly technically comparable. While each patent relates to a different aspect or subsystem of the LTE standard, each is directed to an invention which is one of the many inventions required to reduce the standards to practice and implement the LTE technology, and in particular, they each relate to enabling LTE

[2] In identifying whether technical similarities exist between these patents, among other sources considered, I referenced a publicly available memorandum on the Unwired Planet vs. Huawei Approved Judgement by Unwired Planet.

communications on handsets. Each patent is further directed to: (1) novel features of the LTE standard versus its predecessors; (2) novel method of implementing LTE; (3) proposals for improving the performance of LTE systems such as increasing its throughput, decreasing its latency, or increasing its bandwidth.

Unwired Planet Patents

90. Patent EP2229744 discloses a mechanism for radio link control polling for continuous transmission within the wireless communication network and broadly relates to the reliable data communications aspect of LTE.

91. Patent EP2119287B1 and EP2485514A1 both broadly relate to the self-organizing network aspect of LTE. Patent EP2119287B1 discloses the determination of parameters for handoff, generation, or modification of neighbor cell lists, self-configuring and optimization of neighbor cell lists. EP2485514A1 discloses reducing the cost of planning and maintaining neighbor cell sets by requiring mobile terminals to make an additional effort to identify uniquely neighboring cells in the radio network.

92. EP1230818 relates to the mobile communications field in general and to a method for improving the performance of handovers between different mobile communication systems using SlowACCH in particular and broadly relates to the multi-network handover aspect of LTE.

93. EP1105991A1 discloses a method and apparatus for synchronizing transceivers of different users and even more particularly to methods and apparatus for synchronizing based on orthogonal sequences having optimized correlation properties and broadly relates to synchronization of transceivers in LTE.

Samsung Patents

94. USRE44105 discloses a mechanism for FTT pre-coding of data to reduce peak-to-average power ratio (PAPR) in a multi-carrier wireless network and broadly relates to the encoding aspect of LTE.

95. US8619726 discloses an apparatus and method for transmitting and receiving packets in a mobile communication system supporting Hybrid Automatic Repeat reQuest, soft-combining packets using persistent resources in a mobile communication system supporting HARQ and broadly relates to the reliable data communications aspect of LTE.

96. US8761130B2 discloses multiplexing control and data information in single-carrier frequency division multiple access (SC-FDMA) communication systems and broadly relates to multiplexing on the LTE uplink.

97. US8509350 discloses transmitting power setting information in a downlink Physical Downlink Shared Channel (PDSCH) in a communication system and broadly relates to power management on the downlink in LTE.

98. US9288825 discloses Initiating communications on a shared channel, working with short IDs as UE moves to new cell and broadly relates to connecting to the base station when moving to a new cell in LTE.

99. US9113419 discloses Transmitting power setting information in a downlink Physical Downlink Shared Channel (PDSCH) in a communication system and broadly relates to power management on the downlink in LTE.

April 27, 2018
Date

MICHAEL A.M. DAVIES

EXHIBIT 1

MICHAEL A.M. DAVIES

Senior Partner and Chairman | Endeavour Partners | michael@endeavourpartners.net

Founder | Silverthread Inc. | michael@silverthreadinc.com

Senior Lecturer | Massachusetts Institute of Technology | mamd@mit.edu

Guest Lecturer | London Business School | mdavies@london.edu

Michael Davies has worked for nearly thirty years in the telecommunications and related industries with a particular focus on innovation in mobile devices, communications services and network infrastructure. His expertise spans the design, development and deployment of mechanical, electrical, electronic and high tech products; manufacturing; software coding; video; supply chain management; research and development; technology; and strategy.

As the Senior Partner and Chairman of Endeavour Partners, Michael:

- leads a firm specializing in the connections between technology, innovation, product development, consumer choice and behavior, the adoption and diffusion of new products, intellectual property, and the emergence and evolution of mobile and digital ecosystems
- provides consulting services to companies throughout the mobile industry, including cellular infrastructure providers, mobile device manufacturers, and mobile network operators, as well as traditional companies that are being impacted by technology
- provides expert witness testimony on matters related to intellectual property and public policy within the mobile and digital industries

As Founder of Silverthread Inc., Michael:

- leads a company that helps clients diagnose and improve the design architecture of large software systems to improve predictability of project schedules, reduce unnecessary overhead costs, and prevent compounding complexity

As a Senior Lecturer at MIT, Michael:

- created and teaches courses in fundamental and advanced topics in integrated design and product development process
- teaches topics including innovation, emerging technologies, product management, product marketing, basic finance and business models, pricing and marketing, competitive analysis, market opportunity identification, funding entrepreneurship, business plan & pitch, and data-driven decision making

As a Guest Lecturer at the London Business School, Michael:

- manages and teaches the New Technology Ventures Program, which enables would-be entrepreneurs to evaluate novel ideas and inventions and turn them into new technology ventures

EDUCATION

LONDON BUSINESS SCHOOL 1989-1991
MBA (*WITH DISTINCTION*)
Business Strategy, Technology Management And Decision Sciences
Participation In the PhD Program On Systems Dynamics
Post-graduate study in Systems Thinking

UNIVERSITY OF DURHAM, UK 1982-1984
MASTER OF ENGINEERING
Microelectronics
Cybernetics And Robotics
Management Science

ST CATHARINE'S COLLEGE, UNIVERSITY OF CAMBRIDGE 1979-1982
MASTER OF ARTS
Electrical Sciences Tripos (Computer Science, Mathematics, Engineering and Physics)
Engineering Part I And Part II

HARVARD BUSINESS SCHOOL
Post-graduate study in Innovation & Organizations

SPECIALIST EXPERTISE

Michael Davies' expertise covers the spectrum of strategic challenges that the leaders of technology businesses must work to confront:

- anticipating the future – developing insight into the co-evolution of the demand opportunity, business ecosystem and technical infrastructure, with a particular focus on quantifying demand and determining consumers' purchase preferences and buying behavior
- developing robust strategies – identifying opportunities and options, for initiatives, investments and business models to create and to capture value
- executing effectively – aligning activities with emerging opportunities, as well as adapting for new and different episodes in the co-evolution of the enterprise and its environment

He has several areas of specialist expertise relevant to these challenges:

- the economics of communication networks, in particular shared infrastructure, wireless, broadband and packet networks (LTE base stations)
- the economics of hardware electronic systems, in particular semiconductor and hardware manufacturing, modern computing systems, and consumer electronics
- creative business models, co-opetition and building business ecosystems, including open innovation, open source and other innovative approaches
- the economics of innovation, standards and intellectual property (trade secrets, patents and licensing strategies), and in particular how to create and capture value from technological innovation, or commoditize others' IP to protect value
- the economics of systems, platforms, architecture and modularity, in particular as this relates to complex products and services that combine software and computers

- consumer behavior and segmentation, for high-tech products such as consumer electronics
- strategy and management for R&D, product creation and technological innovation
- how management and knowledge-intensive technical teams, such as R&D people, work together

His R&D experiences, particularly in the design of hardware and systems, include:

- Member of Motorola's R&D Advisory Board
- Member of Telecom New Zealand's R&D Board
- Initial development team member of the Nokia Communicator (while at BellSouth New Zealand)
- Principal Investigator for a National Science Foundation funded research program for MIT
- Senior Lecturer in MIT's Integrated Design and Management program with appointment in the Institute for Data, Systems, and Society

EXPERT REPORTS AND TESTIMONY EXPERIENCE

- United States of America et al. v. AT&T Inc. et al.
  - Department of Justice, anti-trust investigation, Civil Action No. 11-01560 (ESH)
  - Expert Report (2011)
- Apple v. Samsung Electronics America, Inc., Samsung Telecommunications America LLC, and Samsung Electronics Co., Ltd.
  - International Trade Commission investigation No. 337-TA-796
  - Expert Declaration (2013)
- Ericsson Inc. and Telefonaktiebolaget LM Ericsson v. Samsung Electronics America, Inc., Samsung Telecommunications America LLC, and Samsung Electronics Co., Ltd.
  - International Trade Commission investigation No. 337-TA-862
  - Expert Report, Rebuttal Expert Report, Expert Witness Statement, Deposition Testimony, Trial Testimony (all 2013)
- Samsung Electronics Co., Ltd. and Samsung Telecommunications America, LLC v. Ericsson Inc. and Telefonaktiebolaget LM Ericsson
  - International Trade Commission investigation No. 337-TA-866
  - Expert Report, Rebuttal Expert Report, Deposition Testimony, Trial Testimony (all 2013)
- InterDigital Communications, Inc., InterDigital Technology Corporation, IPR Licensing, Inc. and InterDigital Holdings v. Samsung Electronics America, Inc. and Samsung Telecom America, LLC
  - International Trade Commission investigation No. 337-TA-868
  - Expert Report, Rebuttal Expert Report, Deposition Testimony, Expert Witness Statement, Trial Testimony (2013-2014)
- Sasken Communication Technologies Limited v. Spreadtrum Communications, Inc. and Spreadtrum Communications USA
  - American Arbitration Association, International Centre for Dispute Resolution No. 50-117-T-00924-12
  - Expert Report, Trial Testimony (2013-2014)
- On Track Innovations LTD v. T-Mobile USA, Inc.
  - United States District Court, Southern District of New York No. 12-cv.02224-AJN-JCF
  - Expert Report, Deposition Testimony (2013-2014)
- Enterprise Systems Technologies v. Samsung Electronics America, Inc., Samsung Electronics Co. Ltd. and Samsung Telecommunications America, LLC
  - International Trade Commission investigation No. 337-TA-925
  - Expert Report, Deposition Testimony (2015)

- NVIDIA Corporation v. Samsung Electronics America, Inc., Samsung Electronics Co. Ltd. and Samsung Telecommunications America, LLC
  - International Trade Commission investigation No. 337-TA-932
  - Expert Report, Deposition Testimony, Trial Testimony (2015)
- Nokia Corporation v. Samsung Electronics Co., LTD
  - Arbitration, International Chamber of Commerce No. 19602/AGF/RD (c.19638/AGF)
  - Expert Report, Trial Testimony (2015)
- Ericsson Inc. and Telefonaktiebolaget LM Ericsson v. Apple, Inc.
  - International Trade Commission investigation No. 337-TA-952
  - Expert Report, Deposition Testimony, Trial Testimony (2015)
- Core Wireless Licensing S.A.R.L. v. LG Electronics, Inc., and LG Electronics Mobilecomm U.S.A., Inc.
  - United States District Court, Eastern District of Texas No. 2-14-cv-00911-JRG-RSP
  - Expert Declaration, Expert Report, Deposition Testimony (2015)
- ParkerVision Inc. v. Apple Inc., Samsung Electronics Co., Ltd and Samsung Electronics, Inc., LG Electronics, Inc., and LG Electronics Mobilecomm U.S.A., Inc., and Qualcomm Inc.
  - International Trade Commission Investigation No. 337-TA-982
  - Expert Report, Deposition Testimony (2016)
- T-Mobile U.S.A., Inc. v. Huawei Device U.S.A., Inc., and Huawei Technologies Co Ltd.
  - United States District Court, Western District of Washington No. 14-cv-01351-RAJ
  - Expert Report, Declaration, Deposition Testimony (2016), Declarations, Trial Testimony (2017)
- Immersion Corporation v. Apple Inc., and AT&T Mobility LLC.
  - International Trade Commission Investigation No. 337-TA-1004/990
  - Expert Report (2016), Deposition Testimony, Trial Testimony (2017)
- Netlist, Inc. v. SK hynix America Inc., SK hynix Inc., SK hynix memory solutions Inc.
  - International Trade Commission Investigation No. 337-TA-1023
  - Expert Report, Deposition Testimony, Trial Testimony (2017)
- Andrea Electronics Corporation v. Samsung Electronics America, Inc., Samsung Electronics Co., LTD
  - International Trade Commission Investigation No. 337-TA-1026
  - Expert Report, Deposition Testimony (2017)
- Motorola Solutions, Inc. v. Hytera America, Inc., and Hytera Communications America (West), Inc.
  - International Trade Commission Investigation No. 337-TA-1053
  - Expert Report (2017)

PROFESSIONAL EXPERIENCE

Endeavour Partners

Founder and Chairman **2003 – Present**

Endeavour Partners is a technology strategy consulting firm that works with the top management teams of leading businesses throughout the high-tech, mobile and digital business ecosystems, to drive growth and innovation, and to build team capabilities. The firm is headquartered in Cambridge, MA, with an office in London, United Kingdom.

Technical Experience

Michael and his team have experience working throughout the digital ecosystem, across mobile, Internet and digital convergence and commerce. This includes extensive work on communications, in particular mobile devices (feature phones, smartphones, tablets, cameras, connected home, home automation), services (video/PnP, data, messaging, mobile payment, barcode, Bluetooth), components (codecs, sensors) and networks (network infrastructure and equipment), broadband and internet, computing (from semiconductors through personal computing to software services),

consumer electronics, content (video, audio, gaming), commerce and the convergence of these domains. The firm specializes in technological innovation, the adoption and diffusion of new products, and the emergence and evolution of business ecosystems from a systems point of view.

Clients
Leading network operators and service providers, including Verizon Wireless, AT&T, Sprint, T-Mobile, Vodafone, and BT and network infrastructure providers such as Crown Castle, Samsung and Lucent, and most of the leading mobile device/connected home OEMs, including HTC, Samsung, Apple, Nokia, LG, Sony Ericsson, and Motorola. His work also includes standards work for the GSMA, the leading network operator association. Most recently, his work in this area has been focused on the rapid shift toward smartphones, what is driving this shift, and what will be the key market winning criteria over the next 3-5 years.

Recent Work (IP and strategy work)
Corporate strategy, business strategy, technology strategy and product creation including:

- being the technical expert for the Department of Justice on the anti-trust case of the proposed AT&T and T-Mobile merger in 2011. Conducted, with his team, extensive analysis of the potential impact of the merger on competition, overall consumer welfare and in particular the network economics. This included an evaluation of the future evolution of wireless infrastructure, and the resulting costs and economics, over the medium term, under a range of different scenarios.
- being a technical and industry expert on Standard Essential Patents (SEPs) on mobile connectivity and related mobile services for an IP arbitration case
- being a technical expert on a patent case related to the capture and decoding of real-time video signals and communication on smartphones
- being a technical expert on various wireless standard creation, including prior art and invalidity expert for the leading wireless network operator association
- being a technical expert in the area of audio codecs for a leading mobile device manufacturer
- being an expert on a number of ITC cases involving wireless infrastructure/network, mobile devices/connected home devices, software applications and ecosystems
- developing strategies for wireless carriers on video/PnP, 4G and LTE technologies, Bluetooth and data/messaging, particularly around innovative business models
- being an expert on contract disputes involving computer software and licensing
- developing the video and media platform strategy for one of the world's largest and most successful network operators and service providers
- developing strategies on Internet and mobile advertising for various services providers, including market sizing, opportunity assessment and business model deployment
- developing strategies on connected home products and connectivity standards within the home
- driving strategies in NFC technology and mobile payments for a major wireless carrier, including a deep technical analysis of competing solutions, as well as assessment on the surrounding business ecosystem, viable business models and drivers and consumer adoption patterns
- developing a comprehensive projection of the medium and long-term demand for all digital services and devices, and the related attributes driving consumer choice and preference,

including projected market share for major players under a variety of alternative scenarios, and the strategic implications

- driving strategies on software innovation and content management for the world's largest information technology provider
- providing external stimulus and challenge to the top management team on the renewal of product creation for one of the world's largest, most complex and fastest-changing R&D organizations, which was one of the world's largest software development organizations) with ~20,000 people in R&D
- developing an "R&D University" with the world's top academics for the top management team of the #1 mobile device vendor
- mapping the future of the consumer electronics and connected home devices, computing and communications business ecosystem for the world's #1 consumer electronics business
- driving the renewal of technology management for a multi-billion dollar broad scope global technology business, with activities from semiconductors through software platforms to devices and complete solutions
- support for corporate and business strategy for top-tier service providers and network operators (such as BT and Deutsche Telekom), for software businesses, innovative start-ups and infrastructure vendors.

Silverthread, Inc.
Founder **2013-present**
Silverthread's services and tools help clients diagnose and improve the design architecture of large software systems to improve predictability of project schedules, reduce unnecessary overhead costs, and prevent compounding complexity. Silverthread's clients include large corporations and government entities that own and manage large, complex software systems.

EquuSys
Chief Technology Officer **2004-present**
Led development of the company's patented solution, including the development of a hardware electronics sensor product and the accompanying software. EquuSys is a telemetry and informatics company that provides real-time real-world data to enhance the evaluation, diagnosis, rehabilitation, training and conditioning of elite horses.

Mercator Partners
Founder and Chairman Emeritus **1998 – 2009**
Thought leader for the firm; designed, directed and delivered all training programs in strategy and technology. Its alumni have gone on to top strategy roles with a number of industry leading firms, including Google, HTC, Nielsen, Yahoo!, Sony Ericsson, HTC and Vodafone. His work with clients focused on how to build creative new business models and develop effective business strategies, including:

- for the leading US mobile company, work on building business ecosystems, on challenging its business strategies, and on understanding customers and their likely behavior
- for a major global JV with European and Japanese parents, understanding emerging applications and potential business models

- for the most successful MVNO in the world, a range of work including strategies for data services, market entry and partnership development
- for several high-tech R&D-intensive businesses across consumer electronics, telecommunications, automotive and aerospace, looking at how to commercialize highly-innovative technologies
- for the #1 US communications infrastructure company, work on customer needs, and on its strategy for 3G mobile
- for a leading Japanese consumer electronics and industrial conglomerate, a wide range of work on the evolution of consumer electronics, on monetizing its semiconductor intellectual property, on consumer segmentation, on creative business models and on product portfolios, pipeline and positioning
- work with a variety of media companies on business models and content plays in the Internet and mobile service space
- for a leading European mobile operator, developing novel values- and lifestage-based consumer segmentations that enabled it to increase customer loyalty and reduce its costs
- for UK 3G auctions, assembling a consortium bid (SpectrumCo), and raising >$4 billion for an innovative business model, with players such as Virgin, Sonera, Nextel, and Tesco
- for several broadband and IP players, developing business models and market entry strategies
- for several top-tier private equity players, (such as The Carlyle Group, Providence Equity, Kohlberg Kravis Roberts, Blackstone and Berkshire Partners) due diligence and strategic counsel on technology and telecoms investments.

GeoPartners Research
Principal **1996-1998**
Technology evaluation and strategy focused on broadband, IP and next generation wireless technologies:

- for AT&T, overall corporate strategy, including IP, VoIP, local entry, wireless and broadband, including network infrastructure and equipment (including NAT and DNS for VoIP)
- for Qualcomm, evaluating new technologies, business ventures, and organizational design
- for HP, Northern Telecom (subsequently Nortel Networks) and Intel, work on business models and building business ecosystems

BellSouth International
Chief of Strategy, BellSouth NZ (now Vodafone NZ) **1993-1996**
Corporate and business strategy, government relations and industry relations, and R&D, including:

- pioneered the first PDA with digital cellular connectivity (Apple Newton, Nokia Data Card and Nokia 2110) and collaborated with Nokia on the development and testing of the very first modern smartphone, the Nokia Communicator
- elected as a Vice-Chairman of the GSM MoU (later became the GSMA); founder and chairman of its 3rd Generation Interest Group; chaired Government working parties on PCS Spectrum
- built the business from pre-launch through to profitability, which has now become the clear market leader and Vodafone's most successful business worldwide

- designed and drove a path-breaking multi-million dollar global academic research program on the economics of communications, networks and technologies in deregulated markets, whose participants included: Jean-Jacques Laffont; Jean Tirole; Paul David; David Teece; David Gabel; and Glenn Woroch

Boston Consulting Group
Manager **1991-1993**
Focused on technology and telecoms businesses, including Philips Electronics, Telecom NZ, Telstra and in particular BellSouth International. Responsible for training programs in advanced analytical techniques for strategy development.

Braxton Associates
Manager **1987-1991**
Worked on a wide range of strategy projects, focusing on electronics and defense businesses in particular, and on corporate strategy, product development, manufacturing and operational transformation, and market entry. Played a leading role in development and training, focusing in particular on approaches to organizational transformation.

Mars Electronics
Engineer **1984-1987**
Worked as roboticist, cyberneticist and designer, developer and program manager for large scale real-time systems for manufacturing and logistics. Involved in the development of overall business strategy.

Cookson Group
Engineer **1982-1984**
Worked as a robotics engineer and automation manager overseeing and supporting many existing robotic handling and other automation systems. Designed, developed, and deployed additional state of the art robotic and automation systems for manufacturing processes and material handling.

TEACHING EXPERIENCE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Senior Lecturer – Integrated Design and Management
Invited to create and teach as part of Integrated Design Lab I and Integrated Design Lab II (EM.441 and EM.442), courses that present fundamentals of and advanced topics in integrated design and product development process.

Developed and taught fundamental concepts including innovation, emerging technologies, product management, product marketing, basic finance and business models, and pricing and marketing. developed taught advanced topics including competitive analysis and market opportunity identification, funding entrepreneurship, business plan & pitch, and data-driven decision making.

Senior Lecturer – Engineering Systems Division (now Institute for Data, Systems, and Society)
Responsible for creating, managing and teaching two capstone leadership courses, the Systems Leadership & Management Lab (ESD.39) and Praxis (ESD.S51).

SL&M Lab is a semester-long course in which SDM Fellows work an average of at least one full day per week (~fifteen person-days) with the top management of a high-tech business on a relevant real-world systems and management challenge. The host companies set the project focus; that is project teams work on the problems that are of real concern to the host companies.

The course also includes an intense focus on how to work effectively with these types challenges, including team roles, logical thinking and writing, and the use of graphical communication. Assignments can range from a high-level systems thinking issue, through to building a prototype. SDM

students take this experience with them as they work with their sponsoring companies or continue in their career progression and development.

The SL&M Praxis course is about *praxis, practice, as distinguished from theory; application or use, as of knowledge or skills.* The course gives SDM Fellows insights into the realities of decision-making and managerial behavior in large, complex high-tech and systems businesses. It provides them with a systematic approach and the practical skills needed for the application of their rich and deep learning and frameworks about systems, architecture, technology and strategy to real-world leadership and management challenges. It runs during the summer session as a complement to and preparation for the SL&M Lab course.

Senior Lecturer – Bernard M. Gordon-MIT Engineering Leadership Program, School of Engineering
Taught the capstone undergraduate leadership course, Engineering Leadership (ESD.045), and Technology & Strategy (15.905/15.965).

The Bernard M. Gordon-MIT Engineering Leadership Program (http://web.mit.edu/gordonelp/) fosters new approaches that prepare the nation's young engineering leaders for productive and effective careers in engineering companies and continues MIT's rich, innovative tradition of engineering leadership. The Engineering Leadership course exposes students to the models and methods of engineering leadership within the contexts of conceiving, designing, implementing and operating products, processes and systems.

The Technology & Strategy course provides a strategic framework for managing high-technology businesses. Its emphasis is on the development and application of ways of thinking or mental models that bring clarity to the complex co-evolution of technological innovation, the demand opportunity, business ecosystems, and decision-making and execution within the business.

These tools provide managers with insights when anticipating and deciding how to respond to the behavior of competitors, complementors, and customers, and when deciding which technologies to invest in, opportunities to target or partnerships to pursue.

Principal Investigator – Engineering Systems Division (now Institute for Data, Systems, and Society)
Involved in the research on the improvement of software project outcomes by attacking complexity and technical debt as part of a National Science Foundation (NSF) I-Corps program.

Researcher and Thesis Advisor
Supervises thesis work on related areas, including recent prize-winning work on the future of the smart grid, and theses on a broad range of issues.

Conducts research on how psychology shapes consumers' buying behavior and how product features and specifications influence consumers' choices among products and their liking for products. This culminated in a keynote presentation at MIT in Europe, held in Vienna, Austria.

LONDON BUSINESS SCHOOL

New Technologies Ventures Program
Manages and teaches this unique program that brings together MBAs and business students from London Business School with post-doctoral researchers from University College London.

The goal of this course is to enable would-be entrepreneurs to evaluate novel ideas and inventions and turn them into new technology ventures. Participants, who are business professionals, scientists, engineers and would-be entrepreneurs, explore how entrepreneurs and investors identify and analyze the feasibility of innovative technical ideas, turn them into products and services, and take these products and

services to market, in both start-ups and established businesses. A key element of the program is projecting demand for innovative products and new product features.

PROFESSIONAL AFFILIATIONS

Recognized as a World Class New Zealander (March 2007)
Appointed to U.S. Beachhead Board of New Zealand Trade & Enterprise (NZTE) (July 2006)
Member, Board of Directors, Massachusetts Technology Leadership Council (MassTLC)
Co-Chairman, Mobile Cluster, Massachusetts Technology Leadership Council (MassTLC)
Member, Board of Advisors, Department of Systems Engineering at the United States Military Academy at West Point
Member, Executive Committee, Boston Area Chapter of the Communications Society of the Institute of Electrical and Electronic Engineers (IEEE)
Member, Association for Computing Machinery (ACM)
Member, Academy of Management
Member, Strategic Management Society
Member, INFORMS
Member, Product Development Management Association (PDMA)
Leader, London Business School alumni in North America
Founder and President, Kiwi Expatriates Association (KEA) in New England
Member, Board of the Kendall Square Association

EXHIBIT 2

Materials Considered

Exhibit 2: Materials considered
Expert Report of Michael A M Davies

Materials Considered

Documents Produced

	Title
1	L17L81275-BIC6327-H405-Administrative Complaint-EN-20170829-YXN
2	L17L81273_ZL201010146531.3_Complaint-SEHZ-20170814-WJJ-GUH-final
3	LZI10392-SZC817-H405-Invalidation Decision-TSTC-20170517-YXN-CN
4	ZL200610058405.6-PatentSpecification
5	ZL200610058405.6-OA1-Amended claims and specification-20160612
6	ZL200610058405.6-OA1-OA text-20160612
7	ZL200610058405.6-OA1-Observation-20160612
8	ZL200610058405.6-VoluntaryAmendment-Amended claims and specification-20160612
9	ZL200610058405.6-VoluntaryAmendment-Observation-20160612
10	ZL200610058405.6-ApplicationTextOriginallyFiled-20160612
11	Claim chart-from H
12	English version of CN102215085A---EP2547023A1
13	LZI10398-SZC841-H531-Invalidation Decision-SEHZ-20170522-zli-en
14	ZL201010146531.3-English translation of the granted claims
15	ZL201010146531.3-English version of Spec-EP2547023A1
16	ZL201010146531.3-Prosecution_History_Translation English translation of the granted claims
17	ZL201010146531.3-Prosecution_History_Translation Observation to the 1st Office Action
18	ZL201010146531.3-Prosecution_History_Translation Observation to the 2nd Office Action
19	ZL201010146531.3-Prosecution_History_Translation The examination process
20	译文-L17L81273_ZL201010146531.3_Complaint(draft)-20170811-WJJ.DOC_zh-CN_en-US
21	LZI10398-SZC841-H531-Invalidation Decision-SEHZ-20170522-zli-en
22	ZL201010146531.3-English translation of the granted claims
23	ZL201010146531.3-English version of Spec-EP2547023A1
24	ZL201010146531.3-Prosecution_History_Translation
25	L17L81269-SZC842-H130-complaint-SEHZ-EN-20170522
26	LZI10399-SZC842-H130-Invalidation Decision-EN-20170301
27	1. ZL2011102641302-grant-claims & spec-20160614
28	ZL201110261302-rectification2-amended claims-20160613
29	ZL201110264132-oa1-amended claims-20160612-hqi
30	ZL201110264132-oa1-research report-20160612
31	ZL201110264132-rectification1-amended claims-20160612-hqi
32	ZL2011102641302-grant-claims & spec-20160614
33	ZL2011102641302-oa1-observation-20160613
34	ZL2011102641302-oa1-text of oa1-20160613
35	ZL2011102641302-OrginalSpecifiation(EN)-20160613
36	ZL2011102641302-Rectification1-text-20160613
37	ZL2011102641302-Rectification2-text-20160613
38	US8996003 B2
39	US8483166 B2
40	US8412197 B2
41	US8644239 B2
42	US8639246 B2
43	US8369278 B2
44	US8885583 B2
45	US8885587 B2
46	US8724613 B2
47	US8812848 B2
48	US8416892 B2
49	Huawei Technologies Co., Ltd. et al v. Samsung Electronics Co., Ltd. et al CAND-3-16-cv-02787

Patents at Issue

	Patent #	Title
1	US 2013/0028192 A1	information
2	US 2009/0303956 A1	Method, device and system for assigning ACK channels to users
3	CN 100571106C	Wireless Network Communication Device
4	CN 201110264130	Method, device and system for assigning ACK channels to users
5	CN 201010146531	information
6	CN 200610058405	Wireless Network Communication Device

Patents

Patent #	Title	Link

Materials Considered

Exhibit 2: Materials considered
Expert Report of Michael A M Davies

	Materials Considered		
1	US20110242997A1	Extended uplink control information (uci) reporting via the physical uplink control channel (PUCCH)	https://patents.google.com/patent/US20110242997A1/en?q=UCI&q=decoding&q=carrier&before=priority:20100407
2	CN102282819A	Multi-carrier wireless communication system and a transmission method of an uplink control information link means	https://patents.google.com/patent/CN102282819A/en?q=UCI&q=decoding&q=carrier&before=priority:20100407
3	US 2010/0322114 A1	Method of allocating uplink ACK/NACK channels	rage.googleapis.com/a9
4	US 2009/0285122 A1	Uplink control for time-division duplex with asymmetric assignment	rage.googleapis.com/bd
5	KR20080096351A	A method for transmitting control channel in a communication system	https://patents.google.com/patent/KR20080096351A/en?oq=KR20080096351A
6	USRE44105E1	Apparatus and method for FT pre-coding of data to reduce PAPR in a multi-carrier wireless network	https://patents.google.com/patent/USRE44105E1/en?oq=USRE44105
7	US8619726B2	Apparatus and method for transmitting and receiving packets in a mobile communication system supporting hybrid automatic repeat request	https://patents.google.com/patent/US8619726B2/en?oq=US8619726
8	US8761130B2	Control and data signaling in SC-FDMA communication systems	https://patents.google.com/patent/US8761130B2/en?oq=US8761130
9	US8509350B2	Methods and apparatus for downlink PDSCH power setting	https://patents.google.com/patent/US8509350B2/en?oq=US8509350
10	US9288825B2	Method and apparatus for initiating communications on a shared channel in a mobile communications system	https://patents.google.com/patent/US9288825B2/en?oq=US9288825
11	US9113419B2	Methods and apparatus for downlink PDSCH power setting	https://patents.google.com/patent/US9113419B2/en?oq=US9113419
12	EP2229744B1	Method and arrangement in a wireless communication network	https://patents.google.com/patent/EP2229744B1/en
13	EP2119287B1	Self configuring and optimisation of cell neighbours in wireless telecommunications networks	https://patents.google.com/patent/EP2119287B1/en
14	EP2485514 A1	telecommunications networks	.com/patents/EP248551
15	EP1230818B1	Method for improving handovers between mobile communication systems	https://patents.google.com/patent/EP1230818B1/en17
16	EP1105991A1	Communication methods and apparatus based on orthogonal hadamard-based sequences having selected correlation properties	https://patents.google.com/patent/EP1105991A1/en